Appendix III

Amendment 15 to the Sea Scallop FMP

Economic Model

1.1 APPENDIX III – ECONOMIC MODEL

1.1.1 ESTIMATION OF PRICES, COSTS, PROFITS AND NATIONAL BENEFITS

The economic model includes an ex-vessel price equation, a cost function and a set of equations describing the consumer and producer surpluses. The ex-vessel price equation is used in the simulation of the ex-vessel prices, revenues, and consumer surplus along with the landings and average meat count from biological projections. The cost function is used for projecting harvest costs and thereby for estimating the producer benefits as measured by the producer surplus. The set of equations also includes the definition of the consumer surplus, producer surplus, profits to vessels, and total economic benefits.

1.1.2 Estimation of annual ex-vessel prices

Fish prices constitute one of the important channels through which fishery management actions affect fishing revenues, vessel profits, consumer surplus, and net economic benefits for the nation. The degree of change in ex-vessel price in response to a change in variables affected by management, i.e., scallop landings and meat count, is estimated by a price model, which also takes into account other important determinants of price, such as disposable income of consumers and price of imports.

Given that there could be many variables that could affect the price of scallops, it is important to identify the objectives in price model selection for the purposes of cost-benefit analyses. These objectives (in addition to developing a price model with sound statistical properties) are as follows:

- To develop a price model that uses inputs of the biological model and available data. Since the biological model projects annual (rather than monthly) landings, the corresponding price model should be estimated in terms of annual values.
- To select a price model that will predict prices within a reasonable range without depending on too many assumptions about the exogenous variables. For example, the import price of scallops from Japan could impact domestic prices differently than the price of Chinese imports, but making this separation in a price model would require prediction about the future import prices from these countries. This in turn would complicate the model and increase the uncertainty regarding the future estimates of domestic scallop prices.

In the past SAFE reports and Scallop Amendment and Frameworks, the average ex-vessel price for scallops was estimated from an annual price model as a function of total landings, average meat count of scallops landed, disposable income of consumers, and average import prices. Collection of price data by market category of scallops since 1998, however, made it possible to improve the price model by taking into account the changes in the size composition of scallops. The composition of scallops changed significantly in the last ten years toward larger sizes as a result of effort-reduction measures, area closures, and an increase in ring sizes implemented by the Sea Scallop FMP. The share of U10's increased to 27% in 2007 from 7% in 2000 and the share of count 11-20 scallops increased from 18% in 2000 to over 50% in 2007 (Table 52).

The scallop price by market category is affected by the relative abundance or supply of that size category relative to total scallop landings. Until the 2005 fishing year, U10 scallops had a significant price premium, but as their supply in landings increased, the difference in the annual average price of U10's and other size categories declined and in 2006, average price of U10s actually was lower than the price for other size categories (Table 53). The price model developed originally for Framework 18 captured these changes by estimating the prices by major meat count categories and including the relative share of each category in total supply of scallops as an explanatory variable.

Table 1. Composition of scallop landings by market category

Year	U10	11 to 20	21 to 30	Over 30
1999	19%	13%	29%	39%
2000	8%	21%	49%	22%
2001	4%	27%	56%	13%
2002	5%	16%	73%	5%
2003	7%	25%	65%	3%
2004	8%	45%	46%	2%
2005	14%	62%	22%	2%
2006	24%	55%	20%	1%
2007	26%	56%	14%	4%
2008	24%	55%	19%	1%

Table 2. Average annual price of scallops by market category (2008 prices)

Year	U10	11 to 20	21 to 30	Over 30
2000	7.8	7.9	7.3	6.4
2001	8.7	6.8	5.9	6.1
2002	7.2	4.7	4.4	4.7
2003	6.7	4.8	4.5	5.1
2004	5.7	4.8	4.8	5.3
2005	6.8	5.8	5.5	5.7
2006	8.8	8.6	8.5	8.3
2007	6.6	7.3	7.6	7.6
2008	7.2	6.9	6.8	6.2

In addition to the changes in size composition and landings of scallops, other determinants of ex-vessel price include level of imports, import price of scallops, disposable income of seafood consumers, and the demand for U.S. scallops by other countries. The main substitutes of sea scallops are the imports from Canada, which are almost identical to the domestic product, and imports from other countries, which are generally smaller in size and less expensive than the domestic scallops. An exception is the Japanese imports, which have a price close to the Canadian imports and could be a close substitute for the domestic scallops as well.

The ex-vessel price model estimated below includes the price, rather than the quantity of imports as an explanatory variable, based on the assumption that the prices of imports are, in general, determined exogenously to the changes in domestic supply. This is equivalent to assuming that the U.S. market conditions have little impact on the import prices. An alternative model would estimate the price of imports according to world supply and demand for scallops, separating the impacts of Canadian and Japanese imports from other imports since U.S. and Canadian markets for scallops, being in proximity, are highly connected and Japanese scallops tend to be larger and closer in quality to the domestic scallops. The usefulness of such a simultaneous equation model is limited for our present purposes, however, since it would be almost impossible to predict how the landings, market demand, and other factors such as fishing costs or regulations in Canada or Japan and in other exporting countries to the U.S. would change in future years.

Since the average import price is equivalent to a weighted average of import prices from all countries weighted by their respective quantities, the import price variable takes into account the change in composition of imports from Canadian scallops to less expensive smaller scallops imported from other countries. This specification also prevents the problem of multi-colinearity among the explanatory variables, i.e., prices of imports from individual countries and domestic landings. In terms of prediction of future ex-vessel prices, this model only requires assignment of a value for the average price of imports, without assuming anything about the composition of imports, or the prices and the level of imports from individual countries. The economic impact analyses of the fishery management actions usually evaluate the impact on ex-vessel prices by holding the average price of imports constant. The sensitivity of the results affected by declining or increasing import prices could also be examined, however, using the price model presented in this section.

The price model presented below estimates annual average scallop ex-vessel price by market category (PEXMRKT) as a function of

- Meat count (MCOUNT)
- Average price of all scallop imports (PIMPORT)
- Per capita personal disposable income (PCDPI)
- Total annual landings of scallop minus exports (SCLAND-SCEXP)
- Percent share of landings by market category in total landings (PCTLAND)
- A dummy variable as a proxy for price premium for Under 10 count scallops (DU10).

Because the data on scallop landings and revenue by meat count categories were mainly collected since 1998 through the dealers’ database, this analysis included the 1999-2008 period. All the price variables were corrected for inflation and expressed in 2008 prices by deflating current levels by the consumer price index (CPI) for food. The ex-vessel prices are estimated in semi-log form to restrict the estimated price to positive values only as follows:

Log (PEXMRKT) = f(MCOUNT, PIMPORT, PCDPI, SCLAND-SCEXP, PCTLAND, DU10)

The coefficients of this model are shown in Table 54. Adjusted R2 indicates that changes in meat count, composition of landings by size of scallops, domestic landings net of exports, average price of all imports, disposable income, and price premium on under 10 count scallops and 2005 dummy variable explain 82 percent of the variation in ex-vessel prices by market category. In contrast to the price model estimates for the earlier years, the coefficient for the landings net of exports was not statistically significant for the period 1999-2008 for the range of landings observed in this period probably because annual variation in landings in recent years were relatively small and the change in the composition of landings toward larger scallops had a larger impact on prices.

In addition, values of the all the explanatory variables are held at the recent levels. For example, disposable income per capita and import prices are assumed to stay constant at the 2008 level. This is because it is not possible to predict accurately the changes in the future values of the explanatory variables and also because our goal is determine the response in prices to the change in landings and the composition in terms of market category given other things held constant. Therefore, future prices could be higher (lower) than predicted depending on the values of the explanatory variables.

Table 3. Regression results for price model

Regression Statistics	
R Square	0.85
Adjusted R Square	0.82
Observations	40

Table 4. Coefficients of the Price Model

Variables	Coefficients	Standard Error	t Stat
INTERCEPT	-1.18096	0.49743	-2.37
MCOUNT	-0.00414	0.00185	-2.23
PIMPORT	0.21944	0.05449	4.03
PCDPI	0.06606	0.01124	5.87
SCLAND-SCEXP	-0.00131	0.00458	-0.29
DU10	0.05008	0.05106	0.98
PCTLAND	-0.23569	0.08327	-2.83

These numerical results should be interpreted with caution, however, since the analysis covers only 10 years of annual data from a period during which the scallop fishery underwent major changes in management policy including area closures, controlled access, and rotational area management.

1.1.3 Estimation of trip costs

1.1.4 Trip Costs

Data for variable costs, i.e., trip expenses include food, fuel, oil, ice, water and supplies. The trip costs per day-at-sea (ffiwospda) is postulated to be a function of vessel crew size (CREW), vessel size in gross tons (GRT), fuel prices (FUELP), and dummy variables for trawl (TRW) and small dredge (DFT) vessels. This cost equation was assumed to take a double-logarithm form and estimated with data obtained from observer database. The empirical equation presented in Table 56 estimated more than 70% of the variation in trip costs and has proper statistical properties. Table 57 shows the estimated model for the fuel costs with similar statistical properties.

Table 5. Estimation of total trip costs per DAS used

The MODEL Procedure

Nonlinear GMM Summary of Residual Errors

Equation	DF Model	DF Error	SSE	MSE	R-Square	Adj R-Sq	Durbin Watson
lnffiwospda	6	206	24.9349	0.1210	0.7159	0.7090	1.8100

Nonlinear GMM Parameter Estimates

Parameter	Estimate	Approx Std Err	t Value	Approx Pr > |t|
intc	3.991271	0.3129	12.76	<.0001
grtco	0.286919	0.0499	5.75	<.0001
crewco	0.632637	0.1411	4.48	<.0001
dftco	-0.27828	0.0794	-3.51	0.0006
trwco	-0.39799	0.1559	-2.55	0.0114
fuelpco	0.84357	0.0846	9.97	<.0001

Table 6. Estimation of fuel costs per DAS used

The MODEL Procedure

Nonlinear GMM Summary of Residual Errors

Equation	DF Model	DF Error	SSE	MSE	R-Square	Adj R-Sq	Durbin Watson
lnfuelcpda	6	205	25.7857	0.1258	0.7235	0.7168	1.9435

Nonlinear GMM Parameter Estimates

Parameter	Estimate	Approx Std Err	t Value	Approx Pr > |t|
intc	3.605563	0.3133	11.51	<.0001
grtco	0.32617	0.0504	6.47	<.0001
dftco	-0.33534	0.0865	-3.88	0.0001
trwco	-0.18154	0.0955	-1.90	0.0588
crewco	0.389788	0.1383	2.82	0.0053
fuelpco	1.248935	0.0834	14.98	<.0001

Table 7. Comparison of actual and estimated values for trip costs

		Year			
		2005	2006	2007	2008
Estimated trip costs per DAS		1483.39	1445.47	1603.01	1896.45
Actual trip costs per DAS		1306.36	1672.22	1684.29	2094.69
% Difference		15.46	-8.16	-2.48	-1.94
DAS per trip		11.29	9.36	11.00	10.50
LPUE	Mean	2143.67	1365.38	1229.04	1158.69
Actual fuel costs per DAS		939.45	1265.24	1284.92	1703.74
Estimated fuel costs per DAS		1034.55	1022.35	1182.27	1545.78
% Difference		14.42	-12.15	-5.31	-0.61
Fuel price (06)		2.08	2.16	2.33	3.15
GRT	Mean	163.14	146.91	167.64	124.00
HP	Mean	857.00	897.55	1025.07	507.25
LEN	Mean	82.41	80.64	86.01	76.13
Built	Mean	1981.00	1989.18	1982.50	1976.25
% Fuel		0.72	0.75	0.77	0.81
% Fuel Predicted cpred		0.70	0.70	0.74	0.81
N		7.00	11.00	14.00	4.00

1.1.5 Estimation of fixed costs

The fixed costs include those expenses that are not usually related to the level of fishing activity or output. These are insurance, maintenance, license, repairs, office expenses, vessel improvement, professional fees, dues, and utility, interest, communication costs, association fees and dock expenses. The data on these items are obtained from the 2006-07 Cost Survey data. The data included 196 observations and the fixed costs are estimated by using the 97 observations for vessels with dredge and trawl gear. Because the data on communications costs and association fees were missing for most observations, these costs were not included in the estimation but their average values for the scallop vessels were added on to fixed costs.

The following model is based on stepwise regression and estimates fixed costs as a function of length, year built, horse power and a dummy variable for boats that have multispecies permit.

Table 8. Estimation of fixed costs

The MODEL Procedure

Nonlinear GMM Summary of Residual Errors

Equation	DF Model	DF Error	SSE	MSE	Root MSE	R-Square	Adj R-Sq	Durbin Watson
lnfc	5	92	25.7672	0.2801	0.5292	0.5253	0.5047	2.3358

Nonlinear GMM Parameter Estimates

Parameter	Estimate	Approx Std Err	t Value	Approx Pr > |t|
intc	-261.633	85.2438	-3.07	0.0028
lenco	1.335278	0.2650	5.04	<.0001
bltco	35.10611	11.2451	3.12	0.0024
d10co	-0.30008	0.1252	-2.40	0.0186
hpco	0.236827	0.1588	1.49	0.1392

Table 9. Basic fixed costs (do not include improvement costs, includes other costs including fuel and maintenance –double entries)

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Table 3. Basic fixed costs (do not include other costs and improvement costs)

[illegible]

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Table 10. Actual and predicted value of fixed costs for FT dredges: Annual average per vessel; Costs are in 2006 inflation adjusted prices.

DATA		2006	2007
N		25.00	12.00
Fixed costs/vessel		238480.88	236607.88
Predicted fixed cost		244971.88	203595.90
LENGTH	Mean	81.40	76.61
HP	Mean	867.24	577.08
GRT	Mean	154.00	131.50
Hull+Liability Insurance		62121.44	54461.83
Repairs and Maint.		47054.52	72271.92
Improvement Costs		71940.50	66275.00
Other Costs		103194.16	82481.69

Table 11. Average association fee and communication costs by vessel size

	Average annual association fee	Average annual Communication Costs
All Vessels	1610	3446
Large (>=80 feet)	1895	3939
Medium (<80 feet)	1459	3185

1.1.6 Profits and crew incomes

As it is well known, the net income and profits could be calculated in various ways depending on the accounting conventions applied to gross receipts and costs. The gross profit estimates used in the economic analyses in the FSEIS simply show the difference of gross revenue over variable (including the crew shares) and fixed expenses rather than corresponding to a specific accounting procedure. It is in some ways similar to the net income estimated from cash-flow statements since depreciation charges are not subtracted from income because they are not out-of-pocket expenses.

Gross profits per vessel are estimated as the boat share (after paying crew shares) minus the fixed expenses such as maintenance, repairs and insurance (hull and liability). Based on the input from the scallop industry members and Dan Georgianna on the lay system, the profits and crew incomes are estimated as follows:

- The association fees, communication costs and a captain bonus of 5% are deducted from the gross stock to obtain the net stock.
- Boat share is assumed to be 48% and the crew share is assumed to be 52% of the net stocks.
- Profits are estimated by deducting fixed costs from the boat share.
- Net crew income is estimated by deducting the trip costs from the crew shares.

1.1.7 Changes in Revenues, Costs, profits and crew incomes

Table 12. Costs, revenues, crew income and profits (all the values are in 2006 inflation adjusted prices)

Data	1999	2007
Scallop landings per vessel(pound)	103,954	167,831
Scallop revenue per vessel	695,934	1,074,625
Fixed costs per vessel	228,815	246,567
Total trip costs per vessel	86,285	155,056
Shared costs: Communications cost+ Association fees+captain's bonus	40,284	59,148
DAS used per vessel	105	95
Trip costs per DAS	822	1,640
Length	84	82
GRT	161	155
Horse Power	857	837
LPUE	1,149	1,817
Fuel price	0.96	2.30
Ex-vessel price/pound	6.69	6.40
Fuel cost per DA	406	1168
Fuel cost/Trip cost	0.50	0.71
Number of vessels	168	234

Note: For fcgrp<=0.50 23 obs in 1999 and 9 in 2007 are eliminated.

Table 13. Percentage share of costs, profits and crew income in gross stock

Year	Data	Scenario A Out of boat share	Scenario B Out of Gross stock
1999 (Crew share=55% of gross stock)	Net Crew income	296,478	274,322
	Profits	44,071	66,227
	% of Gross Stock (Scallop revenue)		
	Trip costs	13%	13%
	Shared costs	6%	6%
	Fixed costs	34%	34%
	Profits	5%	9%
	Net Crew income	42%	39%
	Total	100%	100%
2007 (Crew share=52% of gross stock)	Net Crew income	403,748	372,992
	Profits	210,104	240,862
	Trip costs	15%	15%
	Shared costs	6%	6%
	Fixed costs	24%	24%
	Profits	19%	22%
	Net Crew income	37%	34%
	Total	100%	100%

1.1.8 Consumer surplus

Consumer surplus measures the area below the demand curve and above the equilibrium price. For simplicity, consumer surplus is estimated here by approximating the demand curve between the intercept and the estimated price with a linear line as follows:

CS= (PINT*SCLAN-EXPR*SCLAN)/2

$$PVCS = \sum_{t=2000}^{t=2008} (CS_t / (1+r)^t)$$

Where: r=Discount rate.

CS_t= Consumer surplus at year "t" in 1996 dollars.

PVCS= Present value of the consumer surplus in 1996 dollars.

EXPR= Ex-vessel price corresponding to landings for each policy option.
PINT=Price intercept i.e., estimated price when domestic landings are zero.
SCLAN= Sea scallop landings for each policy option.

Although this method may overestimate consumer surplus slightly, it does not affect the ranking of alternatives in terms of highest consumer benefits or net economic benefits.

1.1.9 Producer surplus

The producer surplus (PS) is defined as the area above the supply curve and the below the price line of the corresponding firm and industry (Just, Hueth & Schmitz (JHS)-1982).

The supply curve in the short-run coincides with the short-run MC above the minimum average variable cost (for a competitive industry). This area between price and the supply curve can then be approximated by various methods depending on the shapes of the MC and AVC cost curves. The economic analysis presented in this section used the most straightforward approximation and estimated PS as the excess of total revenue (TR) over the total variable costs (TVC). It was assumed that the number of vessels and the fixed inputs would stay constant over the time period of analysis. In other words, the fixed costs were not deducted from the producer surplus since the producer surplus is equal to profits plus the rent to the fixed inputs. Here fixed costs include various costs associated with a vessel such as depreciation, interest, insurance, half of the repairs (other half was included in the variable costs), office expenses and so on. It is assumed that these costs will not change from one scenario to another.

PS=EXPR*SCLAN- ΣOPC
ΣOPC = Sum of operating costs for the fleet.

$$PVPS = \sum_{t=2000}^{t=2008} (PS_t / (1+r)^t)$$

Where: r=Discount rate.

PS_t= Producer surplus at year "t" in 1996 dollars.
PVPS= Present value of the producer surplus in 1996 dollars.
SCALN= Sea scallop landings for each policy option.
EXPR= Price of scallops at the ex-vessel level corresponding to landings for each policy option in 1996 dollars.

Producer Surplus also equals to sum of rent to vessels and rent to labor. Therefore, rent to vessels can be estimated as:

RENTVES=PS – CREWSH

Rentves= Quasi rent to vessels
Crewsh= Crew Shares

1.1.10 Total economic benefits

Total economic benefits (TOTBEN) is estimated as a sum of producer and consumer surpluses and its value net of status quo is employed to measure the impact of the management alternatives on the national economy.

TOTBEN=PS+CS

Present value of the total benefits= PVTOTBEN= PVPS+PVCS

1.1.11 Savings in Trip Costs from leasing DAS: An example

The fishing power and mortality adjustments are expected to prevent a vessel from increasing scallop landings by leasing open area DAS from a larger more efficient vessel. Thus, the scallop revenues that could be obtained from fishing with the leased days are estimated to be equal to the revenues that the lessor could derive from fishing these days. The same argument is valid for leasing the access area trips since the lessee will not be allowed to land any amount larger than the allocated scallop pounds and/or possession limit. Therefore, leasing could increase total profits from the leased days only if the open area days or access area trips could be fished at lower costs on some vessels relative to others and some fixed costs could be reduced. In general, if the leasing vessel can fish the leased pounds (from DAS or access area trip lease) at a lower cost than the lessor, than the difference between revenue and the costs could allow the lessee compensate the lessor and still make a profit. Lessor could gain by earning the same net revenue from the pounds she transferred than fishing those days on her own boat. Even earning a smaller amount of net revenue from the leased DAS or access area trips could benefit the lessor if the value of the leisure time was taken into account.

The relative variable (trip) costs of fishing will depend on the relative LPUE's, the costs of the trading vessels and the adjustment factors. Table 66 shows that even though the larger vessels could catch more scallops per day, average trip costs per pound of scallops do not vary significantly among the HP-length groups because the smaller vessels have lower trip costs per day-at-sea. For example, a vessel in group hp-length group 12 has almost the same trip costs per pound of scallops with a larger vessel in group 82. As a result, fishing the same amount of scallops (in pounds) on a larger vessel compared to a smaller vessel are not expected to lead to large savings in trip costs in most of the cases, narrowing down the returns from leasing DAS on account of trip costs. As discussed in Section ?, however, the production model results indicated that LPUE could increase by 5% when having access to more open area DAS increases the flexibility for the vessel to adjust the trip length optimally according to the resource and market conditions. This could reduce the trip costs per pound of scallops of the lessee as shown in Table 66. For example, if a vessel in group "82" leased open area days from a vessel in group "12', the trip costs per pound of scallops will decline from $0.96 per pound (for group '12' vessel) to $0.89 per pound of scallops (for the leasing vessel in group "82' after trading). Still, these savings are small especially considering that a vessel in group "82" could only use 33 days when it leases 51 days from a vessel in group "12" because of fishing power and mortality adjustments.

Table 14. Full-time Dredge Vessel Characteristics

HP	Length	HP-Length Group	Number of vessels	HP	GRT	Length
<500	50-70	11	5	392	59	61
<500	>70	12	9	431	122	77
500-599	50-70	21	5	523	79	64
500-599	>70	22	25	530	132	77
600-719	50-70	31	4	618	99	66
600-719	>70	32	37	641	146	81
720-863	50-70	41	4	763	119	65
720-863	>70	42	74	814	166	83
864-1036	50-70	51	1	950	111	64
864-1036	>70	52	30	959	167	86
1037-1243	>70	62	38	1,121	183	89
1244-1492	>70	72	12	1,299	178	90
>=1493	>70	82	11	1,545	186	99

Table 15. Scallop landings and trip costs (assuming open area DAS=51)

Fishing power group	Average HP	Average Length	Estimated LPUE (4)	Scallop Pounds landed (5)	Average Trip costs per DAS (6)	Trip costs per pound (7)	Trip costs per pound with increase in LPUE (8)
11	392	61	1,241	63,278	1,186	0.96	0.87
12	431	77	1,296	66,091	1,508	1.16	1.06
21	523	64	1,327	67,688	1,345	1.01	0.92
22	530	77	1,354	69,077	1,598	1.18	1.07
31	618	65	1,376	70,153	1,395	1.01	0.92
32	641	81	1,417	72,290	1,592	1.12	1.02
41	763	66	1,440	73,444	1,601	1.11	1.01
42	814	83	1,494	76,200	1,669	1.12	1.02
52	958	85	1,550	79,045	1,665	1.07	0.98
62	1121	89	1,610	82,100	1,736	1.08	0.98
72	1299	90	1,662	84,773	1,702	1.02	0.93
82	1545	99	1,739	88,694	1,702	0.98	0.89

The total savings in trip costs will depend on the relative fishing power of the trading vessels and the total pounds the lessee can land with the leased days after fishing power and mortality adjustments. Table 67 shows the scallop pounds that can be landed by the leased days and compares the trip costs of the lessor and the lessee, which is assumed to be a vessel in the largest fishing power group (82) in this example. Column 2 shows the days that can be used for fishing by the lessee after leasing, and column 3 shows the estimated scallop landings. For example, if the days are leased from a vessel in group “12”, the lessee can use only 35 days for fishing after the fishing power and mortality adjustments. Total scallop pounds from fishing 35 days are estimated to be 66,091 pounds (Column 3, Table 67), which is equal to the pounds that could be landed by an average vessel in group “12” using 51 days (Table 66, column 5). Column 4 of the Table shows the trip costs for the lessor and column 5 for the lessee of landing 66,091 pounds of scallops. The difference in these total trip costs shows the total gains from trading. Table 67 shows that largest savings in trip costs ($19,944) could be obtained if the lessee (group 82) leased days from a vessel in group 22 in this example. In general, leasing days would lower trip costs in the majority of cases if the overall LPUE increases due to the increased flexibility with access to a larger allocation of open area days. When a larger vessel leases days from a smaller vessel, the trip costs per pound of scallops will also be lower because the larger vessels in general have a higher LPUE. On the other hand, smaller vessels have lower costs per day-at-sea which limits the gains from trip cost savings.

Table 16. Das-used, landings and trip cost savings after a vessel in group 82 leases 51 open area days from other groups.

Lessor	Lessee=Group 82					
	DAS-used after leasing (2)	Scallop landings (3)	Total Trip costs of the lessor (4)	Total Trip costs of the lessee (5)	Savings in trip costs (6)	Trip cost savings per DAS (for an allocation of 51)
11	33	63,278	60,485	56,366	4,119	81
12	35	66,091	76,909	58,872	18,037	354
21	35	67,688	68,595	60,294	8,301	163
22	36	69,077	81,475	61,531	19,944	391
31	37	70,153	71,150	62,490	8,659	170
32	38	72,290	81,173	64,394	16,779	329
41	38	73,444	81,664	65,421	16,243	318
42	40	76,200	85,129	67,876	17,253	338
52	41	79,045	84,911	70,410	14,501	284
62	43	82,100	88,550	73,132	15,419	302
72	44	84,773	86,825	75,513	11,312	222
82	46	88,694	86,819	79,005	7,814	153

If smaller vessels lease days-at-sea from larger vessels, however, there will be no fishing power adjustment to compensate for the lower LPUE. In addition, a 9% mortality adjustment may also be applied. This means that scallop landings and revenues will decline if a small vessel leases days from a larger vessel. For example, if a vessel in group “11” leases 51 open area days from a vessel in group ‘”82”, its landings will still remain at 63,278 pounds, and its revenues from leased days will be $442,946 assuming that the price is $7.00 per pound of scallops. An average vessel in group “82” is estimated to land 88,894 pounds using 51 days-at-sea and earn $620,855 (Table 68). Therefore, the revenue of the smaller vessel will be $177,909 (in Group 11) less than the revenue that the lessor (in Group 82) could obtain from its allocation. As a result, it is unlikely that leasing days from a larger vessel will be profitable for the smaller vessel in group “11” unless the savings in trip and fixed costs outweigh the difference in revenues.

In order to assess the gains from leasing, the increase in boat share and profits should be taken into account, however. The boat shares from leased days are shown in Table 69 and the differences in the boat shares of the lessee and the lessor are shown in Table 70. Boat shares are estimated as 48% of the gross revenue and in case of leased days, savings in trip costs are added to the boat share. This assumption implies that there will be a change in the crew lay system and the trip costs savings will be captured by the owner and net boat shares estimated in Table 69 will be if part of the savings from the trip costs accrued to the crew members. The results show that as long as a vessel leases DAS from a vessel that is either in the same or in a lower HP-length group, the boat share of fishing the open area DAS allocation (51 days in this case) on the leasing vessel will exceed the boat share of the lessor. This surplus will provide opportunity for the lessee to compensate lessor for the amount it could earn by fishing the pounds on her/his own boat and still earn a profit. This analysis does not include any savings in the fixed costs for the lessor or an increase in the fixed costs for the lessee, however. Reduction in fixed costs as a result of the decline in fishing activity could make leasing of DAS more profitable for vessels even if DAS is leased from a larger vessel.

Table 17. The scallop revenue from leased days (51 open area days) compared to the revenue the lessor can obtain from its allocation of 51 open area days

Fish Power group	Lessor 's revenue at 51 days	Lesse's revenue from leasing 51 days											
		11	12	21	22	31	32	41	42	52	62	72	82
11	442,946	442,946	442,946	442,946	442,946	442,946	442,946	442,946	442,946	442,946	442,946	442,946	442,946
12	462,640	442,946	462,640	462,640	462,640	462,640	462,640	462,640	462,640	462,640	462,640	462,640	462,640
21	473,814	442,946	462,640	473,814	473,814	473,814	473,814	473,814	473,814	473,814	473,814	473,814	473,814
22	483,536	442,946	462,640	473,814	483,536	483,536	483,536	483,536	483,536	483,536	483,536	483,536	483,536
31	491,074	442,946	462,640	473,814	483,536	491,074	491,074	491,074	491,074	491,074	491,074	491,074	491,074
32	506,031	442,946	462,640	473,814	483,536	491,074	506,031	506,031	506,031	506,031	506,031	506,031	506,031
41	514,107	442,946	462,640	473,814	483,536	491,074	506,031	514,107	514,107	514,107	514,107	514,107	514,107
42	533,398	442,946	462,640	473,814	483,536	491,074	506,031	514,107	533,398	533,398	533,398	533,398	533,398
52	553,314	442,946	462,640	473,814	483,536	491,074	506,031	514,107	533,398	553,314	553,314	553,314	553,314
62	574,698	442,946	462,640	473,814	483,536	491,074	506,031	514,107	533,398	553,314	574,698	574,698	574,698
72	593,410	442,946	462,640	473,814	483,536	491,074	506,031	514,107	533,398	553,314	574,698	593,410	593,410
82	620,855	442,946	462,640	473,814	483,536	491,074	506,031	514,107	533,398	553,314	574,698	593,410	620,855

Table 18. Boat shares from leased days (51 open area days) compared to lessor's boat share by fishing its allocation of 51 open area days

Fish Power group	Lessor 's boat share at 51 days	Lesse's boat share from leasing 51 days (including savings in trip costs from increase in LP									
		11	12	21	22	31	32	41	42	52	62
11	212,614	218,058	218,058	218,058	218,058	218,058	218,058	218,058	218,058	218,058	218,058
12	222,067	219,241	228,989	228,989	228,989	228,989	228,989	228,989	228,989	228,989	228,989
21	227,431	218,386	228,095	233,604	233,604	233,604	233,604	233,604	233,604	233,604	233,604
22	232,097	219,331	229,083	234,616	239,430	239,430	239,430	239,430	239,430	239,430	239,430
31	235,716	218,390	228,100	233,609	238,403	242,119	242,119	242,119	242,119	242,119	242,119
32	242,895	219,009	228,746	234,271	239,078	242,805	250,201	250,201	250,201	250,201	250,201
41	246,771	218,957	228,692	234,216	239,021	242,748	250,141	254,133	254,133	254,133	254,133
42	256,031	218,977	228,712	234,236	239,043	242,769	250,164	254,156	263,692	263,692	263,692
52	265,591	218,732	228,457	233,975	238,776	242,498	249,884	253,872	263,398	273,233	273,233
62	275,855	218,757	228,483	234,001	238,803	242,526	249,912	253,900	263,428	273,264	283,825
72	284,837	218,447	228,159	233,670	238,465	242,182	249,559	253,541	263,055	272,877	283,423
82	298,010	218,189	227,889	233,394	238,183	241,896	249,264	253,241	262,744	272,555	283,088

Table 19. Difference of the boat shares from leased days (51 open area days) compared to lessor's boat share by fishing its allocation of 51 open area days

	Lessor										
Lessee	11	12	21	22	31	32	41	42	52	62	72
11	5,444	(4,009)	(9,373)	(14,039)	(17,658)	(24,837)	(28,713)	(37,973)	(47,533)	(57,797)	(66,779)
12	6,627	6,922	1,558	(3,109)	(6,727)	(13,906)	(17,782)	(27,042)	(36,602)	(46,866)	(55,848)
21	5,771	6,028	6,174	1,507	(2,112)	(9,291)	(13,167)	(22,427)	(31,987)	(42,251)	(51,233)
22	6,717	7,016	7,185	7,333	3,714	(3,465)	(7,341)	(16,601)	(26,161)	(36,425)	(45,407)
31	5,776	6,033	6,178	6,305	6,403	(776)	(4,652)	(13,912)	(23,472)	(33,736)	(42,718)
32	6,395	6,679	6,840	6,981	7,090	7,306	3,429	(5,830)	(15,390)	(25,654)	(34,636)
41	6,343	6,625	6,785	6,924	7,032	7,246	7,362	(1,898)	(11,458)	(21,722)	(30,704)
42	6,362	6,645	6,806	6,945	7,054	7,269	7,385	7,662	(1,898)	(12,163)	(21,144)
52	6,118	6,390	6,544	6,678	6,782	6,989	7,101	7,367	7,642	(2,622)	(11,604)
62	6,142	6,416	6,571	6,705	6,810	7,017	7,129	7,397	7,673	7,970	(1,012)
72	5,833	6,092	6,239	6,367	6,467	6,664	6,770	7,024	7,286	7,568	7,814
82	5,575	5,822	5,963	6,085	6,180	6,369	6,470	6,713	6,964	7,233	7,468

1.1.12 REFERENCES

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